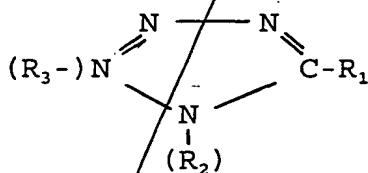


Claims

1. Gas-producing agent for gas generators, comprising nitrogen-containing compounds, characterised in that it contains:

- 5 a) as nitrogen-containing compound (fuel), at least one compound from the group: tetrazole, triazole, triazine, cyanic acid, urea, derivatives thereof or their salts;
- 10 b) as oxidant, at least three compounds from the group of peroxides, nitrates, chlorates or perchlorates;
- 15 c) combustion moderators which are capable of influencing the combustion and its rate by heterogeneous or homogeneous catalysis; and optionally also
- d) additions which are capable of reducing the proportion of the toxic gases.

2. Gas-producing agent according to claim 1, characterised in that it contains as combustibles (nitrogen-containing compounds) one or more tetrazole derivatives of the formula:



30 in which  $\text{R}_1$  and  $\text{R}_2$  or  $\text{R}_3$  can be the same or different, with either  $\text{R}_2$  or  $\text{R}_3$  being present, and standing for hydrogen, hydroxy, amino, carboxyl, an alkyl radical with 1 to 7 carbon atoms, an alkenyl radical with 2 to 7 carbon atoms, an alkylamino radical with 1 to 10 carbon atoms, an aryl radical, optionally substituted

35 with one or several substituents which can be the same or different and are selected from the amino group, the

nitro group, alkyl radicals with 1 to 4 carbon atoms or an arylamino radical in which the aryl radical can optionally be substituted, or the sodium, potassium and guanidinium salts of the said tetrazole derivatives.

5

3. Gas-producing agent according to claim 2, characterised in that

- $R_1$  preferably stands for hydrogen, amino, hydroxy, carboxyl, a methyl, ethyl, propyl or isopropyl, butyl, isobutyl or tert-butyl, n-pentyl, n-hexyl, or n-heptyl radical, a methylamino, ethylamino, dimethylamino, n-heptylamino, n-octylamino or n-decylamino radical, a tetrazole radical, a phenylamino radical, a phenyl, nitrophenyl or aminophenyl radical; and
- $R_2$  or  $R_3$  preferably stands for hydrogen, a methyl or ethyl radical, a phenyl, nitrophenyl or aminophenyl radical.

20

4. Gas-producing agent according to ~~any one of claims 1 to 3~~, characterised in that

- the nitrogen-containing compounds are selected from the group of the tetrazole derivatives and are preferably selected from the compounds 5-aminotetrazole, lithium, sodium, potassium, zinc, magnesium, strontium or calcium 5-aminotetrazolate, 5-aminotetrazole nitrate, sulphate, perchlorate and similar compounds, 1-(4-aminophenyl)-tetrazole, 1-(4-nitrophenyl)-tetrazole, 1-methyl-5-dimethylaminotetrazole, 1-methyl-5-methylaminotetrazole, 1-methyltetrazole, 1-phenyl-5-aminotetrazole, 1-phenyl-5-hydroxytetrazole, 1-phenyltetrazole, 2-ethyl-5-aminotetrazole, 2-methyl-5-aminotetrazole, 2-methyl-5-carboxyltetrazole, 2-methyl-5-methylaminotetrazole, 2-methyltetrazole, 2-phenyltetrazole, 5-(p-tolyl)tetrazole, 5-diallylaminotetrazole, 5-dimethylaminotetrazole, 5-

ethylaminotetrazole, 5-hydroxytetrazole,  
5-methyltetrazole, 5-methylaminotetrazole, 5-n-  
decylaminotetrazole, 5-n-heptylaminotetrazole, 5-n-  
octylaminotetrazole, 5-phenyltetrazole,

- 5 5-phenylaminotetrazole or bis-(aminoguanidine)-  
azotetrazole and diguanidinium-5,5'-azotetrazolate, as  
well as 5,5'-bistetrazole and its salts, such as the  
5,5'-bi-1H-tetrazoleammonium compounds.

- A  
A  
10 5. Gas-producing agent according to ~~any one of claims~~  
1 ~~to 4~~, characterised in that it contains:  
as triazine derivatives, 1,3,5-triazine, as triazole  
derivatives, 1,2,4-triazole-5-one, 3-nitro-1,2,4-  
triazole-5-one, as cyanic acid derivatives, sodium  
15 cyanate, cyanuric acid, cyanuric acid esters, cyanuric  
acid amide (melamine), 1-cyanoguanidine, sodium  
dicyanamide, disodium cyanamide, dicyanodiamidine  
nitrate, dicyanodiamidine sulphate, and as urea  
derivatives biuret, guanidine, nitroguanidine,  
20 guanidine nitrate, aminoguanidine, aminoguanidine  
nitrate, thiourea, triaminoguanidine nitrate,  
aminoguanidine hydrogen carbonate, azodicarbonamide,  
tetracene, semicarbazide nitrate, as well as urethanes,  
ureides such as barbituric acid, and derivatives  
25 thereof.

- A  
A  
30 6. Gas-producing agent according to ~~any one of claims~~  
1 ~~to 5~~, characterised in that it contains as oxidants:  
- peroxides of alkali and alkaline earth metals,  
zinc peroxide, and peroxodisulphates of the said  
elements and ammonium peroxodisulphate, or  
mixtures of these compounds;  
- ammonium nitrate, nitrates of alkali and alkaline  
earth metals, in particular lithium, sodium or  
35 potassium nitrate, and strontium nitrate, or  
mixtures of these compounds;

- halogen oxycompounds of alkali or alkaline earth metals or of ammonium, preferably potassium perchlorate or ammonium perchlorate, or mixtures of these compounds.

5

7. Gas-producing agent according to ~~any one of claims 1 to 6~~, characterised in that it contains as oxidant a combination of zinc peroxide, potassium perchlorate and at least one nitrate, preferably sodium nitrate or strontium nitrate.

10

8. Gas-producing agent according to ~~any one of claims 1 to 7~~, characterised in that the ratio of the oxidants in the gas-producing mixture is 1:2:10, with a total content of 60% by wt.

15

9. Gas-producing agent according to ~~any one of claims 1 to 8~~, characterised in that the ratio of the nitrogen-containing compounds to the oxidants in the mixture is balanced such that on combustion of the gas-producing mixture oxygen is formed in excess.

20

10. Gas-producing agent according to ~~any one of claims 1 to 9~~, characterised in that it contains, as combustion moderators, substances or mixtures thereof which are capable of influencing the combustion and its rate by heterogeneous or homogeneous catalysis, the proportion of these substances in the mixture amounting to up to 8%.

30

11. Gas-producing agent according to ~~any one of claims 1 to 10~~, characterised in that it contains as combustion moderators metals, metal oxides and/or metal carbonates and metal sulphides or mixtures of these combustion moderators, the metals used preferably being boron, silicon, copper, iron, titanium, zinc or

35

molybdenum.

12. Gas-producing agent according to ~~any one of claims~~  
1 to 11, characterised in that it contains as  
5 combustion moderators sulphur, ferrocene and its  
derivatives.

13. Gas-producing agent according to ~~any one of claims~~  
1 to 12, characterised in that it contains, as an  
10 addition, substances which are capable of reducing the  
content of the noxious gases nitrogen oxides and/or  
carbon monoxide.

14. Gas-producing agent according to ~~any one of claims~~  
1 to 13, characterised in that it contains as addition  
15 substance:

- combustion moderators, noble metals such as  
palladium, ruthenium, rhenium, platinum or rhodium  
or oxides of the noble metals, and mixtures of  
20 these compounds, or
- basically reacting substances such as, for  
example, oxides, hydroxides or carbonates of  
alkali and alkaline earth metals, of zinc, as well  
as mixtures of these compounds, or
- 25 - urea, guanidine and derivatives thereof, compounds  
having NH<sub>2</sub> groups such as, for example,  
amidosulphonic acids, amido complexes, amides, and  
mixtures of these compounds.

15. Gas-producing agent according to ~~any one of claims~~  
1 to 14, characterised in that the amount of the  
additions used is about 10 % by wt. in the charge and  
up to 75% by wt. in the outlet passages the amounts  
being based on the gas charge.

16. Gas-producing agent for gas generators, comprising

nitrogen-containing compounds, characterised in that it contains:

- 5 a) as nitrogen-containing compound (fuel), a combination of aminotetrazole and the salts, preferably the calcium, magnesium or zinc salts, of aminotetrazole, preferably a combination of 5-aminotetrazole and the corresponding salts of 5-aminotetrazole;
- 10 b) as oxidant, at least three compounds from the group of peroxides, nitrates, chlorates or perchlorates, preferably sodium nitrate and potassium perchlorate; and
- 15 c) combustion moderators which are capable of influencing the combustion and its rate by heterogeneous or homogeneous catalysis, preferably zinc oxide and the carbonates of zinc and calcium.

17. Gas-producing agent for gas generators, comprising nitrogen-containing compounds, characterised in that it contains:

- 20 a) as nitrogen-containing compound (fuel), urea, its salts, its derivatives and their salts, preferably biuret, guanidine, nitroguanidine, guanidine nitrate, aminoguanidine, aminoguanidine nitrate, 25 thiourea, triaminoguanidine nitrate, aminoguanidine hydrogen carbonate, azodicarbonamide, dicyanodiamidine nitrate, dicyanodiamidine sulphate, tetracene and/or semicarbazide nitrate, as well as urethanes, 30 ureides such as barbituric acid, and their derivatives;
- b) as oxidants, at least two compounds from the group of peroxides, nitrates, chlorates or perchlorates, preferably sodium nitrate and potassium 35 perchlorate; and
- c) combustion moderators which are capable of

influencing the combustion and its rate by heterogeneous or homogeneous catalysis, preferably zinc oxide and the carbonates of zinc and calcium.

*Sub A'* 5 ~~18. Gas-producing agent according to claim 16 or claim 17, characterised in that the oxidants are defined according to claim 6 and the combustion moderators are defined according to any one of claims 10 to 12.~~

10 19. Method of producing a gas-producing agent for gas generators according to any preceding claim, characterised in that the nitrogen-containing compound or compounds (fuel) is/are mixed with the oxidants, the combustion moderators and optionally with further  
15 additions and the mixture is homogenised.

20 20. Method according to claim 20, characterised in that the gas-producing agent is compressed with the use of pressing aids, for example graphite, molybdenum sulphide, Teflon, talc, zinc stearate or boron nitride.

21. Method according to claim 20, characterised in that the blanks are coated.

*A* 25 22. Method according to ~~any one of claims 19 to 21~~, characterised in that a definite porosity of the blank is produced for control of the rate of combustion .

*A* 30 23. Life-saving system containing a gas-producing agent according to ~~any one of claims 1 to 18~~.

*Sub C'* 24. The use of the gas-producing agent according to ~~any one of claims 1 to 18~~ for the production of gas.

*ADD B<sub>1</sub> to 18*  
*ADD H<sub>3</sub>*